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FROM DENATIONALISATION TO WHOLESALE BROADBAND ACCESS: A RETROSPECTIVE OF REGULATORY POLICIES IN THE UK FOR THE COMMUNICATIONS INDUSTRY

ADVAIT DESHPANDE* and ALLAN JONES**

Abstract

This paper examines the shifting regulatory policies in the United Kingdom (UK) across three market segments, telecommunications, radio/television and cable, starting with British Telecom's (BT's) denationalisation in 1984. For the period examined, this paper focuses on following key events –

- The phased liberalisation of the UK communications industry starting with the BT-Mercury Communications duopoly in 1984
- The allocation of cable franchises as regional monopolies in the mid-1980s
- Introduction of satellite broadcasting and the influence of British Sky Broadcasting (BSkyB) Corp. on broadcasting services in the 1990s
- The emergence of the Internet/Web and the subsequent development of a broadband policy from mid-1990s onwards

Drawing on Dodgson et al.'s concepts of Market logic, Coordination Logic, and Complex-Evolutionary Logic, the authors argue that the forms of regulation introduced shaped the ways the UK communications industry developed. Thus although the denationalisation grew out of a free market ideology, in practice the free market philosophy was tempered for a number of pragmatic reasons. Prominent among these was a need to create a competitive market in a context where competitors would be unlikely to emerge without regulatory intervention, and an emphasis on price competitiveness to ensure that the end-users benefitted from the best possible

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prices on available products and services. Subsequent events show that these interventions had unintended consequences. The unforeseen popular demand for Internet/Web access found regulators struggling to find ways to promote a competitive market, and incumbent operators struggling to find a way to offer a suitable product.

Keywords: Coordination logic; Denationalisation of telecommunications; Market logic, UK regulatory policy

1. INTRODUCTION

This paper follows in roughly chronological order the main regulatory interventions relating to the UK communications industry in the approximately three-decade period from 1983. This period is especially rewarding to study because it encompasses the liberalisation of the telecommunications market, the convergence of telecommunications, cable and broadcasting, and the rapid growth of Internet connectivity and broadband. The liberalisation of the UK communications market differed significantly in several respects from that of the USA and the liberalisation that followed elsewhere in Europe (see Perrucci and Cimatoribus, 1997 for a discussion on the different regulatory policies in France, Germany, UK, and the USA). For these reasons, and others, this period and location of telecommunications history merits investigation.

The paper examines both the varying motivations of regulatory policy and the ways in which the regulatory framework developed across different segments of the communications industry – telecommunications, cable, broadcasting, and wireless services.¹ The following narrative combines material from original interviews² with archival material, and other secondary sources to present a retrospective of the regulation in the United Kingdom (UK) communications industry.

¹ The boundaries between these segments have not been clear-cut. Even when these market segments were monitored separately, the services they provided in terms of voice, data, and video overlapped significantly as the following discussion will show.

² The research interviews were conducted from December 2011 to May 2012 by one of the authors. The interview participants were enlisted by contacting a range of industry people identified from the available literature and then actively following up on the references provided by the interview participants. The interviews were done either in person or via a telephone conference. For more details about the interview participants, please see the Appendix section. Although designed to follow a semi-structured format, the interviews were conducted with a flexible approach. The outcome was that most of the interview participants ended up narrating an oral history of their experiences and perspectives on the developments in the UK communications industry for the period under discussion in this paper. In each case, the interview participants were provided a detailed summary of the discussion afterwards and given an opportunity for feedback. Where possible, the testimonies provided by the interview participants have been corroborated with the literature available in the form of journal articles, archival material, and other published sources. The analysis presented in this paper derives from such summaries of the discussions, subsequent checks for accuracy, and any additional feedback, if received. Where anonymised, as in the case of “A senior Cable & Wireless employee”, the name has been withheld according to the participant’s wishes.

1.1. DENATIONALISATION OF UK TELECOMMUNICATIONS

The denationalisation³ of the UK's telecommunications industry in 1983 was the first of a wave of utility-denationalisations begun during Margaret Thatcher's second term as British Prime Minister, following her re-election in 1983.⁴ An overarching principle of these denationalisations was the introduction of competition into former state monopolies to increase efficiency and deliver the best prices to end-users. Each denationalised utility was to have its own independent regulatory body – independent, that is, of the utilities themselves, but having wide ranging powers to impose obligations on utilities in the interests of end-users and in the interests of competition. This paper contends that the interactions of the UK's telecommunications industry and its regulators have profoundly affected the way the telecommunications industry has developed following denationalisation. Although the paper considers interactions between the major communications industries, the focus is on fixed-line communications, that is telecommunications and cable operations.⁵

Regulation of telecommunications in the UK started in 1983 with the formation of the Office of Telecommunications (Of tel).⁶ Of tel was created with the primary purpose of overseeing the denationalisation of British Telecom, which was to be transitioned in stages from a public sector monopoly to, eventually, a completely privatised company (Of tel, 2003a). Also relevant to the story is the creation of the Cable Authority in 1984 to regulate what was intended to be a revitalised cable industry; and the creation of Of com in 2003 to regulate telecommunications, cable and terrestrial broadcasting. The authors contend that these various bodies and their policies were innovations, in so far as they enabled the state to maintain a significant influence on the operation of the businesses while being officially separate.

³ Although the sale of publicly owned assets is generally described as “denationalisation”, in the UK the term “privatisation” was used by the government. As Rutter et. al. (2012, p. 1) describe, the term privatisation “*gained favour simply through the lack of a better alternative*” and because denationalisation “*did not sound positive enough*”.

⁴ The policy of denationalisation adopted by the British Conservative party is attributed by various sources to the free market ideology espoused by Michael Beesley, Keith Joseph, and Stephen Littlechild. Each one of them played a key part into the policy instruments that were adopted in the end. Keith Joseph was the Secretary of State and Industry (from 1979 to 1981) in the Thatcher government and an ardent supporter of introducing competition as a way of improving the functioning of public-sector monopolies (Harrison, 1994). Michael Beesley was with the London Business School and advocated strong market-orientated reforms for a number of utilities and telecommunications (Foster, 1999). Stephen Littlechild was the chief architect of the price regulation policy (Meek, 2012).

⁵ This distinction between telecommunications and cable is mostly attributable to the legacy functions of these market segments. Whereas telecommunications was largely associated with telephony services, cable was associated with television broadcasting. An additional distinction is in the transmission technologies the operators in these market segments relied on. Telephony services were mostly delivered over copper-line Public Switched Telephone Network (PSTN). Cable television was delivered over coaxial cable/hybrid fibre coax network.

⁶ Prior to that the telecommunications was a public sector monopoly operated by the Post Office working as a UK government department. A separate regulatory body to oversee the Post Office functioning or the telecommunications industry did not exist.

1.2. DODGSON ET AL.'S WORK ON INNOVATION POLICY – MARKET LOGIC, COORDINATION LOGIC, AND COMPLEX-EVOLUTIONARY LOGIC

For a theoretical interpretation of the events covered by this paper, the authors draw on the theoretical insights into the innovation policy in Dodgson et al. (2011). Before explaining Dodgson et al.'s analytical framework, however, it is useful to elaborate on what makes Dodgson et al.'s work so appropriate to the present study of regulation in the UK communications industry.

Dodgson et al. are concerned with national policies towards innovation in a market context. However, whereas much thinking on innovation concentrates on successful artefacts, services, or applications, such as the iPhone, the Google search engine, or Facebook, Dodgson et al. say (p. 1154) that innovation should not be seen exclusively in terms of science, technology and R&D (nor, indeed, in terms of success). Rather:

Innovation is an economic act that may rely not on new technology but on new perceptions of market opportunity. Innovation involves business experimentation...

This view accords with the position adopted by the authors of this paper, who see the liberalisation of the UK communications market as an innovation, but one of 'new perceptions of market opportunity' rather than new technology.

A second justification for the use of Dodgson et al.'s work is their framing of innovation and markets in terms of system concepts, particularly those relating to the wider context of legislation and regulation:

Markets are necessarily incomplete arrangements and they are heavily influenced by a range of social, political and legal institutions. Markets are emergent: they facilitate the trading of new kinds of products and services and, although they can arise spontaneously, government support can help develop them and make them work effectively. [p.1153]

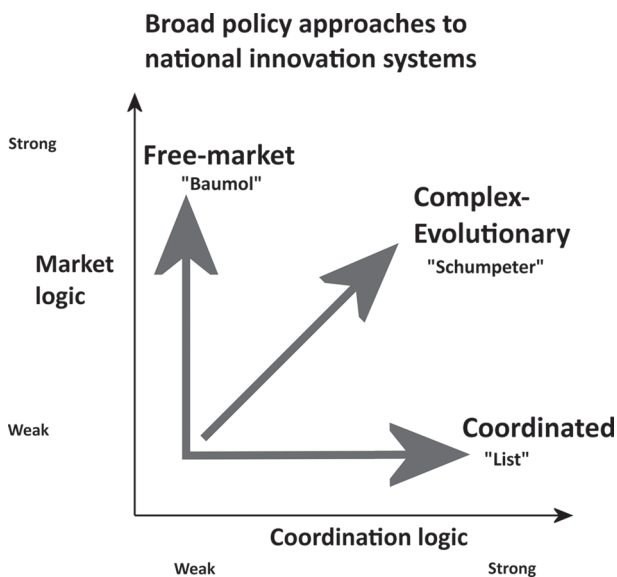
This invocation of wider system concepts is appropriate to the present study, where shifts in the communications market were influenced by multiple interacting factors, including the regulators' changing conceptions of what the market should consist of.

A third justification for the use of Dodgson et al.'s work is the close correspondence between its analytical concepts and process that were seen at work in the evolution of the telecommunications market as narrated below. Thus Dodgson et al. argue (p. 1146) that market failures are not merely anomalous deviations from ideal markets, but are inherent in the way dynamic, innovative markets operate. The narrative part of this paper (below) provides abundant examples of regulatory interventions to fix 'market failures' in the communications sector, and innovations that leave regulators and operators perplexed about the appropriate response.

Having summarised why Dodgson et al's framework for policy analysis is appropriate to the present study, it is necessary to explain the main elements of their framework before embarking on the narrative of communication evolution in the UK.

Dodgson et al. distinguish between policies of Market logic and Coordination logic. These policies approximate to a free market approach ('Market logic') and one of governmental intervention to fix failures in the market ('Coordination logic'). Dodgson et al (2011) clarify that the concepts of Market logic and Coordination logic themselves are derived from the works of Baumol (2002; et. al, 2007) and List (1827; 1838; 1841) respectively. Baumol (2002) focuses on oligopolistic markets and incremental innovation as a way of driving market growth. Baumol et. al. (2007), in turn, further focus on market-led disruptive innovation. Dodgson et. al's assessment of Friedrich List is based on Freeman's (1992) work. In their assessment, the focus of the economic policy advocated by Friedrich List is on long-term policy measures driven by active intervention in the economy.⁷ After offering caveats about the dangers of using simple schemes of categorisation in social sciences, Dodgson et al. explain the policies of Market logic and Coordination logic with the aid of a diagram (Figure 1).

Figure 1. Dodgson et al.'s broad policy approaches to national innovation systems



An example of Market logic is the USA's free-market approach to innovation, encapsulated in writings by William Baumol on Entrepreneurial Capitalism. But, as if to underline the dangers of too simple schemes, Dodgson et al. point out that the US

⁷ According to List (1827; 1838; 1841), the role of the government and the policy makers is to facilitate social inclusive growth via promoting technological competitiveness. For a concise analysis of List's idea of political economy of nationalism, see Levi-Faur (1997).

government's defence expenditure and support for early stage innovation in small firms are characteristic of a 'Coordination logic' approach (p. 1147), where intervention is used to create an outcome that Market logic by itself would not produce.

Coordination logic, by contrast with Market logic, involves state intervention, but this does not imply state control. Rather, Coordination logic is when governments have a coordinating role in relation to markets to encourage desirable outcomes. For example, a government might intervene to ensure technological competitiveness or social inclusion, or to prevent a single winner from taking all. Thus there is no essential conflict between Coordination logic and a belief in markets as the best way to foster innovation. However, Coordination logic is premised on the idea that the free market, left to its own devices, can produce undesirable outcomes, or 'market failures', for which remedial or preventative action in the form of intervention is required. Dodgson et al. cite as exemplars of policies of Coordination logic those of certain Scandinavian countries and developing Asian economies (p. 1147).

The intermediate trajectory in Figure 1, 'Complex-Evolutionary logic' is not associated with any country nor, in the view of the present authors, is it simply a compromise between Market logic and Coordination logic. Certainly it encompasses the necessity of entrepreneurialism for innovation, but sees innovation as unlikely to occur in the neoclassical economists' ideal market. This is because the neoclassical model of perfect competition and rational choice hardly reflects the reality of innovation, which is characterised rather by disequilibrium and radical uncertainty in decision making (p.1148). This indeterminate quality of innovation, according to Dodgson et al., is interpreted (or misinterpreted) as market failure in neoclassical economics. As mentioned earlier, Dodgson et al. argue (p. 1146) that market failures are inherent in the way dynamic, innovative markets operate, and need to be recognised as such by policy makers and innovators. The Complex-Evolutionary approach is associated with the writings of Joseph Schumpeter and evolutionary economists such as Richard Nelson and Sidney Winter (for example, see Nelson and Winter, 1974; 1977).

Dodgson et al. (2011) define their framework in relation to strategies for national innovation policy. This is a somewhat different context from that of the present paper. Nevertheless, the present authors consider that the framework offers useful insights into the regulatory approach to the communications industry in the UK, and in particular to three phases of innovation, which are now outlined. The first phase was the privatisation of the nationalised telecommunications industry in the mid-1980s. The second phase was the attempt to revitalise the cable television industry, also in the mid-1980s. In both of these phases, regulatory policy relied on early interventions, which gave way to an increasingly non-interventionist approach starting in the late 1990s. This is the period where the third innovation takes place: the unforeseen and rapidly growing popular demand for high-speed Internet/Web access. This period can be characterised as "*disequilibrium and radical uncertainty in decision making*" in Dodgson's et al.'s terminology (p.1148), as the telecommunications industry and

regulatory bodies struggled to comprehend an unforeseen shift in the nature of their market.

2. 1980s – STAGED LIBERALISATION OF UK COMMUNICATIONS INDUSTRY

The denationalisation of the UK telecommunications industry happened in stages, beginning in 1983 with an initial privatisation of British Telecom in which the UK government retained a substantial share in the company. Subsequently, during the early 1990s, the government divested itself of its shares in BT (the trading name used by British Telecom 1991 onwards). In the first stage of telecommunications liberalisation, the UK government licensed a competitor to British Telecom. This was Mercury Communications (hereafter “Mercury”), a newly created company owned by a consortium of Cable & Wireless, British Petroleum, and Barclays Mercantile Bank (Mercury Communications Press Office, 1992). The creation of Mercury ended the monopoly in telephony and data that British Telecom had enjoyed prior to its denationalisation.⁸

2.1. RESTRICTIONS ON BRITISH TELECOM

At this stage the focus of regulatory policy was principally on ensuring that British Telecom’s transition into the private sector was successful, while curtailing its dominant market position, and ensuring that competition between British Telecom and Mercury thrived (Carsberg, 1987). Infrastructure competition was part of this policy. Mercury had to build its own trunk (i.e. core) network capacity to a deadline, and for this it chose a ‘figure of 8’ network connecting the major cities of the UK (at an early stage these cities were Birmingham, Manchester, Leeds, Nottingham, Milton Keynes, London, and Bristol. See Mercury Communications Press Office, 1992). However Mercury, in part due to the cost of investment, had no equivalent to British Telecom’s junction (i.e. access) network, and largely relied on interconnect agreements with British Telecom for the ‘last-mile’ connectivity of telephone (and other) services.⁹ British Telecom was required to provide Mercury with access to its local loop (Mercury Communications Press Office, 1992).

⁸ The British Telecom monopoly applied to all areas of the UK except Kingston-upon-Hull. When the various municipal telephone systems licensed under the Telegraph Act 1899 were gradually absorbed into the Post Office telephone department in the early 20th century, the Hull City Council chose to renew its licence in 1914 and remained the only municipally owned telephone corporation in the UK. Kingston-upon-Hull was thus the only area in the UK which was not served by BT, before and after its privatisation. See KCom (2011). Effectively, the creation of Mercury ended BT’s monopoly in all areas except Kingston-uponHull where BT had no footprint.

⁹ A senior C&W employee, Interview with the author. Milton Keynes, 21 December 2011.

British Telecom was subject to further restrictions to prevent it from exploiting its dominant position in the market. Among these was price control over its retail and wholesale services, which is explored in later sections. Other restrictions were designed to limit it from expanding beyond telecommunications into new areas of communications business. In particular, it was prohibited from delivering broadcast services, such as television and on-demand services, on its main network (although on-demand services were permitted from 1993 onwards, and television services from 1999. See BT, 1994; 2000). The intention here was not simply to prevent British Telecom from competing with broadcasters, but to prevent it from dominating the UK cable television industry, which was relatively undeveloped in the UK in comparison with many other countries, and which the government sought to promote. In summary, then, a range of 'Coordination logic' measures was put in place to ensure that the telecommunications market developed competitively, to curb the dominance of the newly privatised British Telecom, and to prevent British Telecom (subsequently BT) moving into other markets.

Cable franchises in the UK at this time (following a change of legislation by Margaret Thatcher's government in 1984) were allocated by the cable industry's regulator, the Cable Authority i.e. CA.¹⁰ The Cable Authority issued franchises not to national operators but as regional monopolies, with the intention of promoting investment in cable infrastructure. The regional monopoly status of cable operators was intended also to foster the creation of original regional television content, in a manner similar to that of the US-cable industry.¹¹ Initially, cable franchise licences did not include telephony, although cable operators could choose to offer telephony on permission from the Director-General of Telecommunications.¹²

The Cable Authority (CA) not only oversaw the franchise allocation but also monitored the adherence to licence obligations of cable operators. Regulation of commercial television and radio in the UK was handled by separate regulatory authorities – the Independent Broadcasting Authority (IBA) and Radiocommunications Agency (RA) respectively.¹³ Although British Telecom was prevented from competing with cable operators through the embargo on its delivering broadcast content, it was allowed a limited presence in the cable industry through ownership. British Telecom

¹⁰ Cable distribution systems for television and radio signals were in operation in the UK since about 1951. Until the end of 1983, with the exception of a few pilot systems, all cabled distribution systems had been authorised to relay only British Broadcasting Corporation (BBC) and Independent Broadcast Authority (IBA) broadcast programmes. With the Cable and Broadcasting Act 1984, the UK government not only established the Cable Authority (CA) but also started granting the first multi-channel cable franchises in November 1983. See VOA (year unknown) for more details.

¹¹ Trevor Smale, Interview with the author. Milton Keynes, 11 April 2012.

¹² Bryan Carsberg, Interview with the author. London, 27 March 2012.

¹³ At this time, the role of Radiocommunications Agency was mostly limited to regulating radio broadcasting and to some extent the wireless communications industry, which operated at a very small scale.

was initially allowed to bid for up to a maximum of 1/3rd of the cable franchises¹⁴, and it could bid for cable franchises only through subsidiary or associate companies (see BT, 1992). Again, the restrictions were designed to prevent British Telecom from transferring its dominance of the telephony market into the cable market. Similar restrictions initially prevented BT from investing in mobile communications except through subsidiary or associate companies (see BT, 1993).

2.2. REGULATING THE INDUSTRY IN A SILOED MANNER

In these early years of denationalisation, some particular ways of thinking about the communications industries and their regulation can be seen. Notably, there was a sense that the communications industry had distinct 'silos' which were to be regulated separately, and which were not directly competing with each other, namely telecommunications, broadcasting and cable. Each of these was its own distinct market, and the regulators' role was partly to shape the market and to maintain its integrity (that is, to prevent one market impinging on another). What defined the silos was an underlying infrastructure, and a technology associated with it. The deep association of infrastructure with service is seen in the way Mercury was required to construct its own core network infrastructure. Regulators were anxious to keep British Telecom within its own telecommunications silo, and within that silo to tilt the playing field somewhat in Mercury's favour, for example by requiring British Telecom to make its access network available to Mercury, so as to promote a competitive market. This approach to regulation is consistent with the 'Coordination logic' outlined earlier. The market was not simply left to itself; instead a number of regulatory policies were implemented in the interests of creating a particular telecommunications ecosystem, to keep certain commercial interests separate, and to configure markets in particular ways.

Another function of regulation was price control, and this had particular consequences for both British Telecom and its competitors. The purpose of price control was to ensure that British Telecom did not profit excessively from its market dominance and from its status as a former public monopoly. Price control was also intended to ensure that British Telecom did not price its competitors out of market. During the early days of duopoly (British Telecom and Mercury) this latter objective meant protecting Mercury from predatory pricing by British Telecom in the retail and wholesale market segments. To begin with, the regulator had the option of price control in a manner similar to that used in the US, where the rate of return achieved by AT&T (originally American Telephone & Telegraph) was regulated (Beesley et al, 1987; Carsberg, 1987). In this method of regulation, although the prices the operators could charge the end-users were not restricted, the profits the operator could earn were regulated. Thus AT&T was required to invest part of its surplus back into the

¹⁴ Bryan Carsberg, Interview with the author. London, 27 March 2012.

system rather than simply earn unrestricted profits on the back of its private monopoly (Meek, 2012). In the UK, after much debate, the approach for price control was based on restricting the revenue the incumbent operator (in this case British Telecom) could earn.¹⁵ For this purpose, a formula based on Retail Price Index (RPI) was devised. The incumbent's prices were to be fixed at $RPI - X$, where X was a percentage value that the regulator (i.e. Ofel) would periodically visit. Thus, to start with, British Telecom's prices would be fixed at $RPI - 3.5\%$ and subsequently revised to $RPI - 7\%$ (Ofel, 2003a).

Although the $RPI - X$ formula was intended to prevent British Telecom from misusing its dominance, it impinged also on British Telecom's competitors who, in order to compete with British Telecom, needed to price their own products relative to British Telecom's prices. The result was a squeeze on the margins of British Telecom's competitors (who, in the 1990s, included the cable operators). The lower revenues in turn affected the return on investment that British Telecom's competitors could achieve.

3. 1990s – THE INCREASED EMPHASIS ON NON-INTERVENTION

During 1991–92, the telephony duopoly of Mercury and BT (as British Telecom was now named) was reviewed for the purpose of further opening up the market or revising the liberalisation policy (see Pye et. al., 1991 for an analysis of the consultation process for the duopoly.) The price-control policy was revised to focus only on those market segments where BT was deemed to be dominant.¹⁶ As a result, a shift of policy was made which enabled regulatory decisions to be based on market conditions rather than on the need to circumscribe BT's power. By the late 1990s, this approach, combined with the European Commission Communications Directive of 1999 (as part of the 1999 Communications Review i.e. COM(1999)539. See EC, 1999), was further consolidated with the introduction of the Significant Market Power (SMP)-based criterion for market intervention as the following sections examine.

¹⁵ The policy of price control was based on the recommendations of the 1983 report "Regulation of British Telecommunications' Profitability" authored by Stephen Littlechild. For a contemporary discussion on the comparison of rate of regulation vs. the RPI-X approach, see Beesley et. al. (1987) and Carsberg (1987). See Cave (2003), Littlechild (2003), and Stern (2003) for a discussion on the policy of price control and its outcomes.

¹⁶ At this stage, market dominance was defined by whether an operator had a majority ownership of a specific market segment. Thus BT was considered to be market dominant in retail, wholesale telephony and international telephony services since it could potentially misuse its position and influence the prices charged to end-users and other operators (Ofel, 1998b). By 1994–95, Mercury was considered to have enough share of the international telephony traffic to similarly impact of end-user prices (See Ofel, 1995). The use of market dominance as a tool to shape policy decisions is important if the implementation of significant market power as a criterion is considered in section 3.

3.1. OPENING UP THE MARKET FOR FURTHER COMPETITION

Cable operators, following the duopoly review referred to above, were allowed to bundle telephony with cable broadcasting without having to ask for permission, as they had formerly. This brought them directly into competition with other telephony providers, notably BT, and provided further leverage for the cable operators whose bundled telephony and television was, potentially, a very attractive package for end-users. Telephony services were further opened up to competition by the removal of the licensing regime which had formerly required new entrants to the market to obtain a licence. Henceforth, any entity with the financial capability could offer telephony services in the UK. As a result, competition in the telephony market increased significantly, with OfTel estimates indicating that over 200 licensed operators existed in the UK market as of 1998, including 5 national carriers, 4 mobile operators, and over 60 companies licensed to operate in international facilities (OfTel, 1998a).

During this time, the cable industry, since it did not have market dominance in broadcasting (or any other market segments), was largely unregulated. The cable industry consequently attracted a good deal of investment, which largely went into building the cable infrastructure. Investors in the main were US-based telcos and cable operators looking to expand into new territories.¹⁷ In particular, the US-telcos looked to invest in the UK because of the rate-of-return regulation they faced in the US.

As with fixed-line telephony, the wireless communications market was opened to further competition from the mid-1990s onwards. With the introduction of Global System for Mobile (GSM)-based mobile services, the number of wireless communications operators in the UK expanded from two to four. The initial duopoly of BT and Racal-Vodafone was expanded to include Mercury One-to-One, and Orange (Hutchison Microtel) (BT, 1994).

3.2. COMPETITION FROM BRITISH SKY BROADCASTING (BSkyB) AND BT'S GLOBAL AMBITIONS

The shift in policy towards a lightening of regulation is seen in other market segments also. With the allocation of cable franchises completed, the Cable Authority was disbanded and with the Broadcasting Act 1990, Independent Television Commission (ITC), was established. (Valuation Office Agency, year unknown). Thus created, the ITC was required “*to ensure fair and effective competition in the provision of television programme services and services connected with them*” (ITC, 1997). At the same time, a major change to the broadcasting landscape occurred with the merger of the two main satellite operators, Sky and British Satellite Broadcasting (BSB), to create British Sky Broadcasting (BSkyB)¹⁸ (see Chippindale et. al., 1991 for a concise history of the

¹⁷ Richard Feasey, Interview with the author. London, 26 April 2012.

¹⁸ Malcolm Taylor, Interview with the author. London, 27 March 2012.

initial competition between Sky and British Satellite Broadcasting, and the events leading up to the merger). The resulting single satellite operator was able to parlay its economies of scale into the successful acquisition of premium broadcasting content in the form of films and sports (such as the English Premier League of soccer, to which BSkyB gained exclusive rights). Given BSkyB's dominance of the premium content market, the cable industry struggled not only to deliver its original promise of creating regional television content but also failed to become financially viable. Starting in the mid-1990s, extensive consolidation and merging took place in the cable industry. By the end of 1990s there were effectively only two cable operators remaining in the UK, NTL (originally National Transcommunications Limited) and Telewest.

During this period of consolidation in the cable industry and the growing dominance of BSkyB in satellite broadcasting, the restrictions on BT regarding broadcasting services had also changed. By 1993, BT was permitted to deliver video-on-demand (VOD) services (BT, 1994), although restrictions on its delivery of television content remained until 1999 (BT, 2000). As the last remaining government shares in BT were sold in 1994, and BT was listed on the stock market, BT's business ambition became aligned more strongly with that of a private, commercial enterprise. With its focus on delivering profits and increasing shareholder value, BT began an ambitious plan of expansion outside the UK.¹⁹ At the same time, throughout this period, BT continued to cite regulatory restrictions placed on it *vis-à-vis* broadcasting services as one of the reasons why a deployment of fibre in the access network was not commercially viable. The result was underinvestment in BT's UK infrastructure assets²⁰, which played a key part in regulatory decisions such as local-loop unbundling, as the following sections discuss.

Taking stock of the period just covered, roughly between the duopoly review of the early 1990s and growth of popular demand for high-speed broadband connection (which is the topic of the next section), competition developed on several fronts through regulatory action. The lightening of the regulatory approach during this period was closer to the free market ideology which formed the impetus behind the utility-denationalisations. This reliance on the Market logic is in contrast to the more interventionist measures adopted in the 1980s. In effect, the walls of the silos were being removed. Cable became a competitor in the telephony market, and the telephony market itself was opened to further competition by the removal of the licence requirement for new entrants. At the same time, earlier policy decisions had

¹⁹ BT undertook an ambitious plan of expanding its operations footprint throughout the 1990s. By the end of 1990s, its operational footprint ranged from Western Europe to North America, Africa and Asia. By the end of financial year 1998–99, BT had fixed-line services in eight mainland European countries: Belgium, France, Germany, Italy, the Netherlands, Spain, Sweden and Switzerland (BT, 1999, p. 46). In addition, in the Asia-Pacific region, BT had a presence in Australia, China, Hong Kong, India, Indonesia, Japan, the Republic of Korea, Malaysia, New Zealand, the Philippines, Singapore, South Africa, Taiwan and Thailand, and was involved variously in fixed, mobile and Internet markets (BT, 1999, p. 46).

²⁰ Malcolm Taylor, Interview with the author. London, 27 March 2012.

repercussions that ran contrary to the new competitive ethos of the increasingly liberalised communications market. The regional structure of the cable industry left it ill-adapted to the new broadcasting landscape, and so the industry was unable to compete effectively with either satellite broadcasting or terrestrial television. The restrictions on BT, together with its own commercial imperative, led to underinvestment in its infrastructure which, although this could not have been known at the time, left the company handicapped when demand for broadband took off in the early years of the new century. Cable too turns out to have been handicapped when the broadband market exploded because of its initial regional configuration.

4. 2000s – THE INTERNET/WEB AND THE CONVERGENCE OF THE REGULATORY FUNCTIONS

By 1999, based on the European Commission Communications Directive (i.e. COM(1999)539. See EC, 1999), the UK market was completely opened up and any remaining restrictions regarding service provision were removed (see Of tel, 1999a for a discussion on Of tel's approach to convergence). The result was that the bundling of telephony, television and wireless services became possible for a number of operators. However, this removal of restrictions on service provision did not mean that the industries became unregulated. As part of the Communications Directive, a regulatory criterion based on significant market power (SMP) was introduced as a way of ensuring the same rules applied for market intervention in all European Union (EU) countries (see Bak, 2003 for a discussion on how SMP would influence competition in the European markets). As adopted by Of tel, the SMP-rule entailed intervention in the markets only when an operator or a group of operators had enough market power to either harm the interests of a competitive market or the interests of the end-user.²¹ This criterion represented the introduction of a market-tested means for introducing prescriptive measures and was intended to strike a balance between too frequent interventions and letting the market stagnate in the absence of strong supervision. However, as the events in relation to the first wave of unbundling described below reveal, this transparent approach to market interventions did not always result in the intended outcome.

In addition to these changes in the different market segments, an important development with implications for regulation was the rapid emergence of popular demand for access to the Internet. This unforeseen change, cutting across telephony, wireless telephony and cable, raised the possibility of an accelerated convergence of

²¹ As defined in section 78 of the Communications Act 2003, "An undertaking shall be deemed to have significant market power if, either individually or jointly with others, it enjoys a position equivalent to dominance, that is to say a position of economic strength affording it the power to behave to an appreciable extent independently of competitors, customers and ultimately consumers". See HMSO (2003).

these market segments and consequently had regulatory implications. This development corresponded at least partly to Dodgson et al.'s Complex-Evolutionary logic, which is characterised by disequilibrium and radical uncertainty, in this case uncertainty about how this rapidly growing demand could be met by the several markets it appeared to straddle, and how regulators should respond in relation to it.

4.1. FOCUS ON BROADBAND CONNECTIVITY

In the UK, the demand for dial-up (or narrowband) Internet/Web connection grew rapidly enough²² during the mid-to-late 1990s not only to provoke a regulatory response in the form of a consultation "Access to Bandwidth: Delivering Competition for the Information Age" (Ofel, 1999b), but also to make improving broadband connectivity a matter of governmental policy.²³ The result was an increased focus on delivering higher speed broadband connectivity. These developments, combined with the 1999 European Commission Communications Directive to allow bundling of services in an unrestricted manner, meant that the regulation of different market segments increasingly began to converge.

At the same time, in line with the European Commission Communications Directive, the focus of UK regulatory policy shifted from infrastructure competition to service competition. In effect, the operators, who until now were encouraged and even required to make infrastructure investments, were no longer obligated to do so.²⁴ The result, as described below, was an increased reliance on BT's wholesale products by other line operators particularly in relation to broadband connectivity, which led first Ofel and then its successor, the Office of Communications (Ofcom), to intervene in the markets. The expectations of high growth in end-user demand for the Internet/Web, and the potential revenue opportunities for the industry, also played a part in the projections of how much wireless data would be worth. These expectations played into the UK's 3G spectrum auction which took place in 1999–2000. This auction raised £22.5 bn for the UK Treasury (National Audit Office, 2001) (See Binmore and Klemperer, 2002 for an inside account of the auction process). However, the high cost of spectrum licences combined with absence of handsets which could use the high-speed data connectivity meant that in the early stages of the 3G rollout the return on investment for the mobile operators was low (Ofcom, 2004).

During this period of growing end-user demand for the Internet and perceived lack of investment in broadband infrastructure on the part of BT, Ofel put its weight behind

²² The UK had 8,000,000 users online in 1998. By 2000 this number had nearly doubled to 15,800,000. See BBC (2008) for a detailed infographic based on the information derived from the International Telecommunications Union (ITU).

²³ The stated goal was for the "UK to have the most extensive and competitive broadband market in the G7 by 2005" (Ofel, 2001b, p. 3). G7 refers to the group of seven developed nations – US, UK, France, Germany, Italy, Canada, and Japan.

²⁴ John Cluny, Interview with the author. Milton Keynes, 19 April 2012.

local loop unbundling (LLU), which had been shown in France and Germany to have the potential to encourage broadband growth (Ofel, 1998b). In LLU, Other Line Operators i.e. OLOs (that is, non-BT operators), were allowed to install their own network equipment in exchanges so that traffic between exchanges could be carried over the OLO's own core networks. (The connection between the exchange and the user remained the existing copper 'local loop', to which BT was required to yield access if a customer signed-up with an OLO). In effect, LLU was a way of introducing competition at the infrastructure level in the last mile. Ofel believed that through LLU, the newly created competitive market would encourage investment in broadband infrastructure, and accelerate the deployment of Digital Subscriber Line (DSL) broadband technologies. As it turned out, the terms on which unbundling was to be allowed in this first round of consultations did not prove attractive to OLOs (Ofel, 1998b; Sandbach and Durnell, 2002), resulting in their opting for wholesale line rental (WLR) solutions, through which they re-sold BT's wholesale broadband products²⁵ (Ofel, 2002; 2003b). As a result, unbundling was not adopted to any significant degree at this stage.

By 2003, the regulatory functions for telecommunications, television, wireless, and data were consolidated into a single regulatory body named the Office of Communications (Ofcom), an indication that the silos isolating these markets were now removed, and that telephony, broadcasting, and data were services that could be delivered over a variety of infrastructures. In the meantime, the growth in popular Internet/Web use and subsequent rollout of DSL broadband by BT, together with the relatively weak position of the cable industry and the slow take up of 3G products, meant that broadband provision in the UK was still dominated by BT, either through its own retail products or through the re-selling of its wholesale products. The result was an intervention on part of Ofcom to encourage deployment of next-generation broadband technologies.

4.2. CORRECTING THE MARKET DEPENDENCE ON BT'S WHOLESALE BROADBAND PRODUCT

By 2004, Ofcom judged that the broadband market was too reliant on BT. The result was the Strategic Review of Telecommunications (often shortened to Telecoms Strategic Review i.e. TSR), which had two phases of consultations aimed at speeding up deployment of the next generation of broadband technologies (such as Asymmetric DSL version 2 i.e. ADSL2) and encouraging investment in broadband infrastructure (Ofcom, 2004a; 2004b; 2004c). One of the possible outcomes discussed in the TSR consultations was that Ofcom would refer BT to the UK's Competition Commission (CC) and recommend a structural separation of BT's network and retail operations

²⁵ Wholesale Line Rental (WLR) refers to a scenario where a non-BT operator "rents" a line from BT for transmission. As opposed to Local Loop Unbundling (LLU) where the nonBT operator deploys their own solution in the last mile, in WLR, the maintenance and ownership of the last mile remains with BT. See Ofel (2002, 2003b).

(Ofcom, 2004b; 2004c). Thus if the structural separation was to take place, BT Group would no longer own the UK-wide core and access network it had inherited as a former monopoly – a critical part of its significant market power in the UK market. However, as part of an agreement with BT, a referral to the Competition Commission was not made, and in response BT agreed to a functional separation of its network operations from its retail operations. Thus a new division, named Openreach, was created in 2006 (see Ofcom, 2006). Although Openreach remained a BT Group company, its function was to deliver network operations such as provision, maintenance and repair to all operators, including BT Retail, on equal terms. BT's retail division would be given no preference or priority in its dealings with Openreach.

Dodgson et al. point out that in the disequilibrium and radical uncertainty associated with genuine innovation, where neither market logic nor coordination logic can be applied, policies tend to be developed pragmatically within the context of “*evolutionary and complex system realities prevailing in a particular country*” (p. 1147). The response of UK regulators to the growth of demand for Internet/Web access shows this pragmatic response through local loop unbundling and functional separation of BT's network and retail operations. These were both attempts to kick-start fresh entrepreneurial activity in a market where the existing entities appeared incapable of meeting rapidly growing demand satisfactorily.

In the wake of the failure of the first round of local loop unbundling, a new and more attractive pricing mechanism for local loop unbundling was unveiled, resulting in a glut of investment by operators such as Bulldog, Tiscali, TalkTalk, and Easynet into the DSL broadband market. Meanwhile, in the cable market, the two remaining operators, NTL and Telewest, were consolidated into Virgin Media. The result of these changes was that by 2007 almost equal shares in the retail market for broadband were held by BT, TalkTalk, and Virgin Media.²⁶ There was thus an oligopoly in the retail broadband segment and the lowest prices for retail broadband products since the introduction of broadband in the early 2000s.²⁷ From this point of view, Ofcom's policy of introducing competition via LLU was successful. However, an important outcome of unbundling was the consolidation of DSL as the prime means of broadband delivery, as investment in next generation DSL broadband technologies such as ADSL2, ADSL2+ was increased. Although investment in fibre within the core network also increased during this period, fibre-to-the-premises remained (and remains) uneconomic or impossible for most UK domestic end-users and small businesses.²⁸

²⁶ In 2009, the market share in the retail broadband segment for BT, Virgin media, TalkTalk and Sky was 25.9%, 22.5%, 24.7% and 12.4% respectively (Ofcom, 2009).

²⁷ The average monthly cost of DSL for residential and small business end-users in November 2001 was £40 (Ofel, 2001a). The average monthly cost of DSL for residential and small business end-users in September 2003 was £22-£24 (Ofel, 2003c). By 2013, when bundled with landline (excluding line rental) the monthly costs were as low as £5.99 depending on speed and data usage (Ofcom, 2013b).

²⁸ The Broadband Stakeholder Group (BSG) report on next generation broadband deployment “Pipe Dreams” (2006) argues that despite the increase in fibre investment, the costs of deploying fibre to the end-user premises in the form of Fibre-To-The-Home (FTTH) connections are

Despite the generally high levels of competitiveness of the UK retail broadband market, regulatory concerns remained about the low level of competition in wholesale broadband access²⁹ and about the poor provision of broadband to one-third of the UK areas (including semi-urban and rural i.e. mostly sparsely populated parts of the UK) which are commercially not viable (Ofcom, 2010). This poor service in rural areas was often characterised as a market failure. In order to boost investment and encourage competition, Ofcom conducted a consultation in 2010, and another consultation was scheduled for completion in September 2013. In 2011, Ofcom revised price caps for BT wholesale broadband products in rural areas where BT was the only broadband provider with exchanges in order to encourage competition (Ofcom, 2011). The intent in reviewing the wholesale broadband access market has been to assess significant market power based on ownership of exchanges in particular areas, to assess the availability of a broadband product from more than one operator, and to pursue remedies that will deliver best prices for end-users along with a choice of service providers (Ofcom, 2013a). Ofcom's focus on the wholesale broadband access market reflects a wider emphasis on broadband provision and improving speeds which has led the UK government to launch an initiative called "Broadband Delivery UK" (BDUK) independently of Ofcom.

The Broadband Delivery UK (BDUK) initiative is another pragmatic response to a lack of entrepreneurial activity. It has been put together *"to provide superfast broadband to at least 90% of premises in the UK and to provide universal access to standard broadband with a speed of at least 2Mbps"* (Department for Culture, Media & Sport, 2013). On a different front, an ambition to extend the length of optical fibre network and deliver superfast/ultrafast speeds³⁰ is apparent in the consultation carried out by the UK's Lords Select Committee on Superfast broadband in 2012 (see House of Lords Select Committee, 2012 for more details). However, given the EU-wide restrictions on state subsidy (EC, 2009), the allocation of funds for BDUK has been done on the basis of competitive bids. A number of companies such as Fujitsu, Geo, and BT have participated, but BT's capability to deliver economies of scale and know-how in fibre deployment has meant that it has won the bids so far. BT's competitors have argued that the BT could potentially gain a fibre monopoly that would be hard to remove, given that, as fibre gets closer to the end-user's premises, unbundling becomes less practical, creating a potential regulatory issue for Ofcom (House of Commons

astronomical. Quoting the Enders Analysis report "Very High Speed Broadband: A Case For Intervention", published in January 2007, BSG suggests that the incremental costs per household are around €60 (£45) for ADSL2+, €300 (£250) for Fibre-To-The-Cabinet (FTTC), and €1000 (£800) for FTTH. Thus the cost of delivering FTTH to even 90% of UK households would be around € 14bn.

²⁹ As defined in the "Review of wholesale broadband access markets", "WBA [Wholesale Broadband Access] products offer the opportunity to enter the broadband market without the need to deploy an access network ... " (Ofcom, 2013a, p. 7).

³⁰ As broadband speeds have continued to increase the definition of what constitutes superfast/ultrafast broadband continues to change. At the time of writing (late 2013), this is deemed to be 100 Mbit/s in the UK. See the House of Lords Select Committee (2012).

Public Accounts Committee, 2013).³¹ Thus the infrastructure owned by BT once again becomes the crucial asset distinguishing BT from other line operators, whose role becomes one of largely re-selling BT's wholesale products. For competitive infrastructures one would have to turn to cable and mobile wireless networks. The BDUK initiative has thus created an unintended consequence of BT consolidating its hold over the fibre infrastructure – a possibility that Ofcom has tried to address in its reviews of wholesale broadband access markets.

As the final part of this narrative has shown, from around 1999, following the rapid growth of demand for broadband access, there has been an expansion of 'Market logic', as the barriers between telephony, cable and broadcasting were removed. Increasingly companies whose roles were defined by their technological infrastructures have developed overlapping roles; and infrastructure, although it has remained a crucial business asset, has been less deterministic in relation to the services the companies have provided. However, this is not to say that 'Coordination logic' became irrelevant in this period. The focus of regulation, though, has tended towards trying to create competitive markets for broadband in a context where BT still dominates, or where (as in rural areas) BT has a virtual monopoly.

5. DISCUSSION AND CONCLUSIONS

Although the denationalisation of the UK's telecommunications system (and other public utilities) may have had its roots in free market idealism, as this article has shown, the reality has largely been one of 'Coordination logic' to prevent distortions or failures of the market. Coordination logic relies on prescriptive measures not only to dictate the behaviour of the market but also to influence the nature of investment and innovation. It is therefore a form of goal-driven intervention, designed to produce particular outcomes, and needs to be understood relative to the circumstances of its application. In principle, Coordination logic as applied to the newly liberalised UK telecommunications market could have served a range of desirable options, depending on what the expectations of market failure were. For instance, regulation might have been oriented towards increased investment in the legacy infrastructure.

³¹ This issue arises because fibre cannot be physically unbundled in the same way as copper. Although solutions such as wavelength unbundling (Hoernig et al., 2010) are being developed, the deployment of fibre itself can take different forms such as point-to-point (P2P) fibre, Gigabit Passive Optical Network (PON), and Wavelength Division Multiplexing (WDM) + PON. Of these, only WDM + PON offers the option for wavelength unbundling in a practical manner. However, unlike GPON solutions (which more than handle today's enduser requirements and are hence widely used), WDM + PON solutions are not yet viable for mass-market deployments. As a result, open-access regulations will have limited relevance until wavelength unbundling becomes possible on a wider scale. See the Independent Networks Cooperative Association (2012) report "Beyond Broadband" for a concise explanation of different types of fibre deployments. See Hoernig et al. (2010) for different configurations and architectures possible in a fibre network.

The main objective of regulatory intervention, though, was low prices to consumers, an indication perhaps that a pure 'Market logic' approach was thought to offer no guarantee of low prices in a market dominated by a single supplier. Also, as the first of the major utility privatisations, the privatisation of British Telecom needed to offer prompt, tangible benefits to consumers if the project of utility de-nationalisation was to continue to command sufficient political support.

Although the intention of denationalisation and regulation was to create a competitive telecommunications market (which is not necessarily synonymous with a free market as a free market could result in a private monopoly), through the approximately three decades covered here the conception of what a competitive telecommunications market might consist of was not fixed. Ideas changed about who was competing with whom, what services should be offered, how the former nationalised provider should act, and at what level competition should operate (for example, whether at the level of infrastructure or services). At first these shifts of thinking took place in a context of gradually developing technologies and customer expectations. The Coordination logic that prevailed during this time itself was subject to modification. For example, in the first stage of denationalisation, the competitive market was to be developed through competing telecommunications infrastructures. Mercury Communications had to create its own core network, although, lacking its own access network, it depended on BT's access network. This equation of the infrastructure with services was also reflected in the setting up of a separate regulatory body for the cable industry. Cable and telecommunications were not considered to be in the same competitive market.

However, as the paper has shown, this conception of fundamental difference was loosened with the provision of telephony by cable companies, and virtually eliminated with the arrival of broadband, a technology in which the infrastructure and service are not so deterministically related. The relatively sudden emergence of a demand for broadband connectivity was something the regulators and operators were little prepared for and one which exposed shortcomings in the industry in its existing form. In particular, lack of sufficient investment in both the telecommunications and cable infrastructure meant that for several years neither system had a suitable product to offer that could attain high market penetration. In the disequilibrium and uncertainty associated with the unexpected demand for Internet/Web access, pragmatic evolutionary approaches were developed to try to re-shape the environment into one that would foster innovative investment. This is seen in the creation of Openreach and the more attractive unbundling rates for OLOs. Out of this emerged service competition over shared infrastructure or multiple infrastructures is seen. End-users could choose from among several service providers, many of them re-selling the same wholesale product; or endusers could choose between similar services provided over distinctly different infrastructures (for example cable and the legacy telephone infrastructure). The point to stress here is that this form of competitive market only became possible through various regulatory strategies which forced BT, as the incumbent operator, to make a wholesale product available to other providers.

Another regulatory strategy, local loop unbundling, worked by entitling other-line operators to assume control of the 'last mile' part of the infrastructure if end-users chose to use those operators. At the level of the services provided over these various infrastructures, however, something closer to Market logic has come to prevail.

The policy of fostering competitive markets through regulation depended on policy makers interpreting matters which, on the face of it, might not seem to be arenas for subjectivity. An instance of this is the way that the regulatory separation of cable and telecommunications can be seen to embody a particular 'reading' of what these technologies stood for.

Telecommunications was understood to be principally for voice and data services, and cable for regionally based entertainment in competition with terrestrial television. Any form of Coordination logic therefore is likely to require an interpretation of what is relevant to an intervention and what is irrelevant. With the passage of time, cable and telecommunications have increasingly come to be seen as alternative ways of providing the same suite of products: telephony, video and broadband. Thus, even as the earlier policy of infrastructure competition abated, a new form of infrastructure competition emerged, between the telecommunications network and the cable network for broadband provision. A similar scenario is seen emerging as mobile telephony mutates into mobile broadband, and enters an arena where it competes with the infrastructures of fixed-line telecommunications and cable.

This 'interpretative' aspect of regulation is especially significant in relation to the role of competition. In the context of British communications industry, regulation has structured the market so as to create low prices for end-users, and a reduction of BT's dominance. However, it is debatable whether these policies have best served the long-term interests of end-users or the industry. As the article has shown, within fixed-line telecommunications since denationalisation, infrastructure investment has increasingly been driven by the economics of Return on Investment (ROI), resulting in under-investment, and in a relatively low penetration of optical fibre outside the core network. And, as the article has also shown, BT's dominance has, ironically, been enhanced through regulatory manoeuvres intended to reduce it. As the outcome of the present round of Broadband Delivery UK (BDUK) funding for next generation access (NGA) shows, there is a possibility of BT achieving a near-monopoly position over the newly deployed fibre infrastructure. Mansell's (1997) observation that following privatisation former monopolies often tend to consolidate their position is pertinent here.

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REFERENCES

- BAK, M. (2003) "European electronic communications on the roads to full competition: The concept of significant market power under the new regulatory framework", *Journal of Network Industries*, 4 (3): 293–324.
- BAUMOL, W. (2002) *The Free-Market Innovation Machine: Analyzing the Growth Miracle of Capitalism*. Princeton University Press.
- BAUMOL, W., LITAN, R., and SCHRAMM, C. (2007) *Good Capitalism, Bad Capitalism, and the Economics of Growth and Prosperity*. Yale University Press.
- BEESLEY, M.E., LAIDLAW, B.H., and GIST, P. (1987) "Prices and competition on voice telephony in the UK", *Telecommunications Policy*, 11 (3): 230–236.
- BINMORE, K. and KLEMPERER, P. (2002) "The Biggest Auction Ever: the Sale of the British 3G Telecom Licences". *The Economic Journal*, 112 (478): C74–C96.
- THE BRITISH BROADCASTING CORPORATION. (2008) *SuperPower: Visualising the internet*, Retrieved September 18, 2013, from <http://news.bbc.co.uk/1/hi/8552410.stm>.
- BRITISH TELECOM. (1992) *Annual report for BT people 1991/92*. London: BT Archives.
- BRITISH TELECOM. (1993) *Annual report on Form 20-F 1993*. London: BT Archives.
- BRITISH TELECOM. (1994) *Annual report on Form 20-F 1994*. London: BT Archives.
- BRITISH TELECOM. (1999) *Annual review and summary financial statement 1999*. London: BT Archives.
- BRITISH TELECOM. (2000) *Annual report and Form 20-F 2000*. London: BT Archives
- BROADBAND STAKEHOLDER GROUP. (2006) *Pipe Dreams? Prospects for next generation broadband deployment in the UK*, Retrieved July 03, 2012, from www.broadbanduk.org/component/option,com_docman/task,doc_download/gid,930/.
- CARSBERG, B. (1987) "Regulation of British telecom: A reply to Beesley, Laidlaw and Gist", *Telecommunications Policy*, 11 (3): 237–242.
- CAVE, M. (2003) "The Littlechild Report: price control and competition in UK telecommunications", In I. Bartle (ed.), *The UK model of Utility Regulation: A 20th anniversary collection to mark the 'Littlechild Report' retrospect and prospect* (pp. 51–55). Proceedings of a joint LBS Regulation Initiative, CRI and City University Business School Conference. Retrieved February 04, 2013, from the Centre for the study of Regulated Industries (CRI) website: www.bath.ac.uk/management/cri/pubpdf/Conference_seminar/31_Model_Utility_Regulation.pdf.
- CHIPPINDALE, P., FRANKS, S., and FELSTEIN, R. (1991) *Dished!: Rise and Fall of British Satellite Broadcasting*. London: Simon & Schuster Ltd.
- DEPARTMENT FOR CULTURE, MEDIA & SPORT. (2013) *Broadband Delivery UK*. Retrieved September 19, 2013, from <https://www.gov.uk/broadband-delivery-uk>.
- DODGSON, M., HUGHES, A., FOSTER, J. and METCALFE, S. (2011) "Systems thinking, market failure, and the development of innovation policy: The case of Australia". *Research Policy*, 40 (9): 1145–1156.

- THE EUROPEAN COMMISSION. (1999) *Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions – Towards a new framework for Electronic Communications infrastructure and associated services – The 1999 Communications Review*, Retrieved June 25, 2014, from <http://eur-lex.europa.eu/legal-content/EN/NOT/?uri=CELEX:51999DC0539>.
- THE EUROPEAN COMMISSION. (2009) *Commission notice on the enforcement of State aid law by national courts*, Retrieved September 19, 2013, from [http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52009XC0409\(01\):EN:NOT](http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52009XC0409(01):EN:NOT)
- FOSTER, C. (1999) *Michael Beesley: An early advocate of road-pricing, he stamped his mark on telecom and rail privatisation*, Retrieved July 20, 2012, from www.guardian.co.uk/news/1999/oct/08/guardianobituaries1.
- FREEMAN, C. (1992) *The Economics of Hope: Essays on Technical Change, Economic Growth and the Environment*. Pinter Publishers.
- HARRISON, B. (1994) “Mrs. Thatcher and the Intellectuals”, *Twentieth Century British History*, 5 (2): 206–245.
- HER MAJESTY’S STATIONARY OFFICE. (2003) *The Communications Act 2003*, Retrieved September 20, 2013, from www.legislation.gov.uk/ukpga/2003/21/pdfs/ukpga_20030021_en.pdf.
- HOERNIG, S., JAY, S., NEUMANN, K-H, PAITZ, M., PLÜCKEBAUM, T., and VOGELSANG, I. (2010) *Architectures and competitive models in fibre networks*, Retrieved October 16, 2013, from www.vodafone.com/content/dam/vodafone/about/public_policy/position_papers/vodafo ne_report_final_wkconsult.pdf.
- THE HOUSE OF COMMONS PUBLIC ACCOUNTS COMMITTEE. (2013) *The Rural Broadband Programme – uncorrected evidence*, Retrieved September 18, 2013, from www.publications.parliament.uk/pa/cm201314/cmselect/cmpubacc/uc474-i/uc474i.pdf.
- THE HOUSE OF LORDS SELECT COMMITTEE. (2012) *Inquiry into Superfast broadband*, Retrieved July 3, 2012, from www.parliament.uk/documents/lordscommittees/communications/Superfastbroadband/SuperfastBroadbandEvidence.pdf.
- THE INDEPENDENT NETWORKS COOPERATIVE ASSOCIATION. (2012) *Beyond Broadband*, Retrieved February 2, 2012, from www.inca.coop/sites/default/files/INCA-Beyond-Broadband.pdf.
- INDEPENDENT TELEVISION COMMISSION. (1997) *ITC Annual report 1997*, Retrieved April 24, 2012, from www.ofcom.org.uk/static/archive/itc/itc_publications/annual_report/1997/index.asp.html.
- KINGSTON COMMUNICATIONS. (2011) *KCOM – Our History*, Retrieved March 7, 2011, from www.kcomplc.com/about-us/our-history/.
- LEVI-FAUR, D. (1997) “Friedrich List and the political economy of the nation-state”, *Review of International Political Economy*, 4 (1): 154–178.
- LITTLECHILD, S.C. (1983) *Regulation of British Telecommunication’s Profitability*, HMSO.

- LITTLECHILD, S. (2003) "The birth of RPI-X and other observations", In I. Bartle (ed.), *The UK model of Utility Regulation: A 20th anniversary collection to mark the 'Littlechild Report' retrospect and prospect* (pp. 31–49). Proceedings of a joint LBS Regulation Initiative, CRI and City University Business School Conference. Retrieved February 04, 2013, from the Centre for the study of Regulated Industries (CRI) website: www.bath.ac.uk/management/cri/pubpdf/Conference_seminar/31_Model_Utility_Regulation.pdf.
- LIST, F. (1827) "Outlines of American political economy", In M. Hirst (Ed.), *Life of Friedrich List and Selections from his Writings*, London: Smith, Elder & Co., 1909: 147–272..
- LIST, F. (1838) *The Natural System of Political Economy* (translated by HENDERSON, W. O.), London: Frank Cass.
- LIST, F. (1841) *The National System of Political Economy* (1991 edition), New Jersey: Augustus M. Kelly.
- MANSELL, R. (1997) "Strategies for Maintaining Market Power in the Face of Rapidly Changing Technologies", *Journal of Economic Issues*, XXXI (4): 969–989.
- MEEK, J. (2012) "How We Happened to Sell Off Our Electricity". *London Review of Books*, 34 (17): 3–12.
- MERCURY COMMUNICATIONS PRESS OFFICE. (1992) *Mercury Communications: The Facts*. Porthcurno: Porthcurno Telegraph Museum. Document number DOC/MCL/1/18.
- NATIONAL AUDIT OFFICE. (2001) *The Auction of Radio Spectrum for the Third Generation of Mobile Telephones*, Retrieved September 19, 2013, from www.nao.org.uk/wp-content/uploads/2001/10/0102233.pdf.
- NELSON, R.R. and WINTER, S.G. (1974) "Neoclassical and Evolutionary Theories of Growth: Critique and Prospectus", *Economic Journal*, 84 (336): 886–905.
- NELSON, R.R. and WINTER, S.G. (1977) "In search of useful theory of innovation", *Research Policy*, 6 (1): 36–76.
- THE OFFICE OF COMMUNICATIONS. (2004a) *The Communications Market 2004*, Retrieved November 7, 2011, from http://stakeholders.ofcom.org.uk/binaries/research/cmr/cm_2004.pdf.
- THE OFFICE OF COMMUNICATIONS. (2004b) *Strategic Review of Telecommunications Phase 1 consultation document*, Retrieved October 15, 2013, from http://stakeholders.ofcom.org.uk/binaries/consultations/telecoms_review1/summary/tcoms_review.pdf.
- THE OFFICE OF COMMUNICATIONS. (2004c) *Strategic Review of Telecommunications Phase 2 consultation document*, Retrieved October 15, 2013, from http://stakeholders.ofcom.org.uk/binaries/consultations/telecoms_p2/summary/maincondoc.pdf.
- THE OFFICE OF COMMUNICATIONS. (2006) *The Communications Market 2006*, Retrieved November 7, 2011, from <http://stakeholders.ofcom.org.uk/binaries/research/cmr/main.pdf>.

- THE OFFICE OF COMMUNICATIONS. (2009) *The Communications Market 2009*, Retrieved November 07, 2011, from <http://stakeholders.ofcom.org.uk/binaries/research/cmr/cmr09.pdf>.
- THE OFFICE OF COMMUNICATIONS. (2010) *Review of the wholesale broadband access markets Consultation on market definition, market power determinations and remedies*, Retrieved September 19, 2013, from <http://stakeholders.ofcom.org.uk/binaries/consultations/wba/summary/wbacondoc.pdf>.
- THE OFFICE OF COMMUNICATIONS. (2011) *Better value rural broadband*, Retrieved September 18, 2013, from <http://media.ofcom.org.uk/2011/07/20/better-value-ruralbroadband/>.
- THE OFFICE OF COMMUNICATIONS. (2013a) *Review of the wholesale broadband access markets Consultation on market definition, market power determinations and remedies*, Retrieved September 18, 2013, from http://stakeholders.ofcom.org.uk/binaries/consultations/review-wbamarkets/summary/WBA_July_2013.pdf.
- THE OFFICE OF COMMUNICATIONS. (2013b) *The Communications Market Report 2013*, Retrieved September 3, 2013, from http://stakeholders.ofcom.org.uk/binaries/research/cmr/cmr13/2013_UK_CMV.pdf.
- THE OFFICE OF TELECOMMUNICATIONS. (1995) *A review of Mercury Communications Limited's telecommunications licence*, Retrieved November 2, 2011, from www.ofcom.org.uk/static/archive/oftel/publications/1995_98/licensing/mercury/mercury.htm.
- THE OFFICE OF TELECOMMUNICATIONS. (1998a) *Oftel's Draft Work Programme for 1998/99 and beyond*, Retrieved November 2, 2011, from www.ofcom.org.uk/static/archive/oftel/publications/1995_98/about_oftel/dwp398.htm.
- THE OFFICE OF TELECOMMUNICATIONS. (1998b) *Access to bandwidth: Bringing higher bandwidth services to the consumer*, Retrieved November 2, 2011, from www.ofcom.org.uk/static/archive/oftel/publications/1995_98/competition/llu1298.htm.
- THE OFFICE OF TELECOMMUNICATIONS. (1999a) *Oftel's response to the UK Green Paper – Regulating communications: approaching convergence in the information age*, Retrieved November 2, 2011, from www.ofcom.org.uk/static/archive/oftel/publications/1999/consumer/gpia0199.htm.
- THE OFFICE OF TELECOMMUNICATIONS. (1999b) *Access to Bandwidth: Delivering Competition for the Information Age*, Retrieved November 2, 2011, from www.ofcom.org.uk/static/archive/oftel/publications/1999/consumer/a2b1199.htm.
- THE OFFICE OF TELECOMMUNICATIONS. (2001a) *Oftel's Broadband and Internet Brief – November 2001*, Retrieved October 31, 2011, from www.ofcom.org.uk/static/archive/oftel/publications/internet/internet_brief/broad1101.pdf.
- THE OFFICE OF TELECOMMUNICATIONS. (2001b) *Delivering a competitive broadband market – Oftel's regulatory strategy for broadband*, Retrieved October 31, 2011, from www.ofcom.org.uk/static/archive/oftel/publications/broadband/other/stratb1201.htm.

- THE OFFICE OF TELECOMMUNICATIONS. (2002) *Wholesale Line Rental*, Retrieved November 1, 2011, from www.ofcom.org.uk/static/archive/oftel/publications/whole_line/2002/wlr1102.pdf.
- THE OFFICE OF TELECOMMUNICATIONS. (2003a) *Oftel Review 1984–2003*, Retrieved November 1, 2011, from www.ofcom.org.uk/static/archive/oftel/publications/about_oftel/2003/celeb_dgarticle.pdf.
- THE OFFICE OF TELECOMMUNICATIONS. (2003b) *Wholesale Line Rental: Oftel's conclusions – statement*, Retrieved November 1, 2011, from www.ofcom.org.uk/static/archive/oftel/publications/whole_line/2003/wlr0303.pdf.
- THE OFFICE OF TELECOMMUNICATIONS. (2003c) *Oftel's Internet and Broadband Brief – September 2003*, Retrieved October 31, 2011, from www.ofcom.org.uk/static/archive/oftel/publications/internet/internet_brief/broad1003.pdf.
- PERRUCCI, A. and CIMATORIBUS, M. (1997) “Competition, convergence and asymmetry in telecommunications regulation”, *Telecommunications Policy*, 21(6): 493–512.
- PYE, R., HEATH, M., SPRING, G. and YEOMANS, J. (1991) “Competition and choice in telecommunications: The Duopoly review consultative document”, *Telecommunications Policy*, 15(1): 10–14.
- RUTTER, J., MARSHALL, E., and SIMS, S. (2012) *The Privatisation of British Telecom (1984)*, Retrieved February 4, 2013, from www.instituteforgovernment.org.uk/sites/default/files/british_telecom_privatisation.pdf.
- SANDBACH, J. and DURNELL, C. (2002) “Unbundling the local network and the incentives for broadband investment”, *info*, 4(2): 23–30.
- STERN, J. (2003) “What the Littlechild Report actually said”, In I. Bartle (Ed.), *The UK model of Utility Regulation: A 20th anniversary collection to mark the ‘Littlechild Report’ retrospect and prospect* (pp. 7–31). Proceedings of a joint LBS Regulation Initiative, CRI and City University Business School Conference. Retrieved February 4, 2013, from the Centre for the study of Regulated Industries (CRI) website: www.bath.ac.uk/management/cri/pubpdf/Conference_seminar/31_Model_Utility_Regulation.pdf.
- VALUATION OFFICE AGENCY. (year unknown) *Section 870: Telecommunications Cable Networks (Previously – Cable TV Systems)*. Retrieved February 7, 2013, from www.voa.gov.uk/corporate/Publications/Manuals/RatingManual/RatingManualVolume5/sect870/b-rat-man-vol5-s870.html.

APPENDIX

Details of the interview participants (in alphabetical order)

Name	Expertise and affiliation in the communications industry (at the time of the interview)
A senior Cable & Wireless employee*	– Communications industry veteran with nearly 30 years of experience
Bryan Carsberg	<ul style="list-style-type: none"> – The first Director-General of Oftel – Oversaw the privatisation of BT and the creation of duopoly – Instrumental in implementing the RPI – X formula for the price cap on BT
John Cluny	<ul style="list-style-type: none"> – A veteran of the UK communications industry – Regulatory economist with a focus on the cable industry
Trevor Smale	<ul style="list-style-type: none"> – A veteran of the UK communications industry – Regulatory expert and advisor – Lengthy stints in NTL and now Virgin Media
Malcolm Taylor	– Former Director of regulatory and public policy at Telewest (later Virgin Media)

* Name withheld at the participant's request.